

Anthocercis sylvicola (Solanaceae), a rare new species from the tingle forests of Walpole, south-western Australia

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Abstract

Macfarlane, T.D. and Wardell-Johnson G. *Anthocercis sylvicola* (Solanaceae), a rare new species from the tingle forests of Walpole, south-western Australia. Nuytsia 11 (1): 71-78 (1996). The rare new locally endemic species *Anthocercis sylvicola* T.D. Macfarlane & Wardell-Johnson is described and illustrated photographically. *Anthocercis sylvicola* is most closely related to *A. genistoides* Miers and *A. anisantha* Endl., but differing most obviously in the smaller green and purple flowers. It is the only member of the genus confined to tall open-forest. Although restricted, its distribution shows a marked discontinuity, a common situation for conservative, relictual high-rainfall taxa in the area. The species is of conservation interest owing to the small area of distribution and small number of plants and populations known. It is listed among conservation priority taxa for Western Australia. A revised key to the spinescent species of *Anthocercis* is presented.

Introduction

During recent studies of plant communities in the south coast area of south western Australia (Wardell-Johnson 1994), a species of *Anthocercis* was found in a vegetation survey quadrat located near Mt Clare, west-south-west of Walpole. Further field work over 3 700 km² of the 'Tingle Mosaic' (*sensu* Wardell-Johnson 1994) has shown it to be rare. Earlier collections were found to exist, collected in the 1960s, but they appear not to have been studied by Haegi (1981) and Purdie *et al.* (1982). As the species differs from described species, it is newly described here. The conservation and biogeographical implications of the discovery are also discussed.

New species description

Anthocercis sylvicola T.D. Macfarlane & Wardell-Johnson, *sp. nov.* (Figure 1)

Frutex spinescens foliosus. Ramuli foliaque pubescentia, pilis pro parte maxima simplicibus. Inflorescentia cymarum parvarum composita vel floribus solitariis, sine ramificatione aperta. Flores virides et purpurei; corollae tubus solide purpureus; corollae lobi caespitibus pilorum apicalium ornati.

Typus: Mt Clare, WSW of Walpole, Western Australia, 20 November 1995, *T.D. Macfarlane* 2543, *A.R. Annels & R.W. Hearn* (*holo*: PERTH 04125320; *iso*: AD, BRI, CANB, K, MEL, MO, NSW, PERTH (2 sheets)).

Spinescent *shrub*, partly pubescent with glandular and non-glandular hairs. *Stems* up to 2.5 m tall and 1.5 cm diam., erect or often fallen to an inclined or horizontal position with erect branches, hirsute when young with simple, multicellular, rather weak hairs, glabrous when old. *Spines* initially one per leaf axil, simple or occasionally branched, 8-14 mm long, subsequently often with a second spine growing out adjacent to the first and diverging from it. *Leaves* primary and secondary, blade 7-11 mm long, 2-4.5 mm wide, more or less flat, soft, relatively thin, obovate, sparsely hairy; simple hairs short, rather stiff, curved retrorsely or occasionally erect or antrorse; glandular hairs short-stalked or subsessile; margins entire; apex acute; petiole 1-1.5 mm long; primary leaves alternate and solitary at each node, caducous; secondary leaves one per node, slightly smaller than the primary one and lateral to the spine, present early on the shoot, further secondary leaves often arising at older nodes and forming a cluster from a bud lateral to the spine at or after the formation of a cyme or branch. *Inflorescence* of terminal or subterminal cymes of up to 5 flowers, or flowers apparently solitary, axillary, often extending for a considerable distance from the shoot apex, usually rather sparse. *Bracts* 2 or 3, *c.* 0.5 mm long. *Pedicels* 2.5-3.5 mm long, articulate near the base, glabrous except for sparse minute glands. *Flowers* horizontal or slightly pendulous, protogynous, with a faint unpleasant odour. *Calyx* green, *c.* 3 mm long, externally glabrous, internally hairy, especially near the apex, hairs short, simple; lobes 5. *Corolla* 7-8.5 mm long; tube glabrous, externally dark purple where exposed, green where covered by the calyx tube, internally purple with or without green longitudinal striations on the sides, except for the lower sides (within the calyx) and floor where it is green and translucent, the rim with regular swellings separated by broad grooves or the swellings so pronounced and numerous as to form a corona; lobes 3.2-4 mm long, triangular, spreading at base, the remainder spreading to erect or somewhat incurved, the margins incurved in the upper part, both surfaces green, sometimes with a fine purple midline, externally glabrous, internally hairy with dense, stalked glandular hairs except just below the apex where there is a small dense tuft of short, simple hairs. *Nectary* annular, well developed, *c.* 0.7 mm tall, thick, surrounding base of ovary. *Fertile stamens* 4, *c.* 2 mm long, 2 slightly longer than the other 2, at first strongly recurved and located in lower part of tube whilst the stigma is apparently receptive, subsequently straightening and lengthening, not reaching the stigma; filaments inserted on tube *c.* 1.5 mm above base, upper part more or less linear, green, often with a dull purple stripe on each side, lower part swollen, longitudinally grooved on inner surface, outer surface with a row of stiff, spreading, simple, white hairs near base. *Staminode* located between the longer stamens, well developed and almost as long as the stamens to less than half as long, with or without an anther vestige, occasionally absent, size and presence varying on individual plants. *Style* with capitate stigma situated at or slightly below mouth of corolla tube. *Ovary* 2-locular, with a total of 18-26 ovules. *Mature capsules* and *seeds* not seen.

Other specimens examined. WESTERN AUSTRALIA: Mt Clare, 21 June 1989, *A.R. Annels* 766 (PERTH); Mt Clare, 23 Aug. 1989, *A.R. Annels* 782 (PERTH); Granite Peak area, campsite off Mitchell Road, 15 Sep. 1994, *A.R. Annels* 4432 & *R. Hearn* (PERTH); Frankland National Park, SE of Granite Peak, *c.* 300 m along track N from Mitchell Road, 22 Sep. 1994, *T.D. Macfarlane* 2219, *A.R. Annels & R. Hearn* (BRI, MEL, NSW, PERTH); Mt Clare, WSW of Walpole, 22 Sep. 1994, *T.D. Macfarlane* 2223, *A.R. Annels & R. Hearn* (PERTH); Deep River, upstream of Tinglewood Lodge, WSW of Walpole, 22 Sep. 1994, *T.D. Macfarlane* 2224, *A.R. Annels & R. Hearn* (Manjimup, PERTH); Warbrook [probably an incorrect locality, see below], Sep. 1965, *R.D. Royce* 8315 (PERTH); Walpole-Nornalup National Park near Mt Clare, 9 Oct. 1993, *G. Wardell-Johnson* 4020 (PERTH); Walpole-Nornalup National Park, Mount Claire [Clare], 14 Oct. 1991, *J.R. Wheeler* 2703 (PERTH); near Deep River, *c.* 6 km W of Walpole, 2 Oct. 1967, *P.G. Wilson* 6312 (PERTH).



Figure 1. *Anthocercis sylvicola* A - terminal cluster of flowers (x6), B - shoot with bud and young aborting fruit (x4.3). Photographs by G. Wardell-Johnson, at type locality, 17 November 1993.

Distribution. In a genus notable for restricted species, this species is the most geographically restricted, with a range area of 0.03 km², and geographic extent of 12 km² *sensu* Mace *et al.* (1992). It occurs in two populations within 1.5 km of one another near Mt Clare on the south coast (the Mt Clare and Deep River populations, approximately 34° 59' S, 116° 43' E), and another 30 km to the north near Granite Peak (34° 43' S, 116° 42' E).

Habitat. The three populations are all in tall open forest, with *Eucalyptus jacksonii* (Red Tingle), *E. guilfoylei* (Yellow Tingle) and *E. diversicolor* (Karri) dominant at Mt Clare (basal area 39 m² ha⁻¹) and the Deep River, and *E. diversicolor* dominant at Granite Peak. Each of these populations is in brown, gravelly, freely drained clay-loam soils in moisture-gaining sites, proximal to water-shedding areas of granite outcrop.

Each of the sites is species-poor, for example, there are 16 vascular plant species in the 400 m² quadrat at the Mt Clare site. *Hovea elliptica*, *Clematis pubescens*, *Trymalium floribundum*, *Pteridium esculentum*, *Opercularia volubilis*, *Acacia pentadenia*, *Tremandra stelligera*, and *Chorizema retrorsum* are dominant understorey species common to the three sites. In addition, *Callistachys lanceolata* and *Acacia divergens* are dominants at the Granite Peak site, and *Acacia urophylla* and *Hibbertia cuneiformis* at the Mt Clare site.

Because the substrate is more moist than surrounding areas, the three populations occur in areas naturally protected from frequent fire. However, it is inevitable that they are burnt occasionally, e.g. both populations in the vicinity of Mt Clare burnt in the high intensity fire of 1951 and probably in 1937 as well. Although the Mt Clare area was burnt by a prescribed fire in early Summer 1979, the immediate area of the *Anthocercis* population did not burn. Similarly, the immediate area of the Granite Peak population did not burn in the prescribed fire of Spring 1989. Two of the three populations (Granite Peak and Deep River) occur adjacent to areas of machine disturbance (gravel scrapes).

Habit and fire response. The response to fire of this species is not known, and fertile fruits have not been seen despite repeated visits. The habit of the plant is unusual. In the long-unburnt area, at Mt Clare, it grows as a semi-erect shrub, with branches bending over and trailing along the ground. It then resumes the semi-erect shrub habit. No evidence has, however, been found of rooting from trailing branches. Nevertheless, there is some difficulty in deciding what constitutes an individual plant.

Flowering and fruiting periods. Flowering September - February. Fruiting season unknown, although immature, aborted fruit collected in December and February.

Conservation status. *Anthocercis sylvicola* occurs in populations of varying size, ranging from a few score at Deep River to thousands at Mt Clare (although the difficulty of deciding what constitutes an individual plant should be noted). The species has been assigned the conservation code Priority 2 (Hearn 1994: see end of this issue for details of the codes). It has previously been assigned the phrase name "*Anthocercis* sp. Walpole (*P.G. Wilson* 6312)" pending its formal description. The species appears to be genuinely rare, given that there has been much informed botanical survey work in the region. However, all three localities are within national parks, and do not face immediate threat other than from fire.

Etymology. The epithet, *sylvicola* (dweller in forests) is from the Latin *sylva* - forest or wood, and *cola* - dweller, in reference to the habitat of the species.

Notes. The specimen listed above as *Royce* 8315 is labelled “Warbrook, W.A. Shrub 1.2 m high, in moist black swampy sand, Sept. 1965, *R.D. Royce* 8315.” We believe that it was misnumbered and as a consequence has also been mislabelled. Our reasons are as follows. (1) The species is otherwise known only from the vicinity of Walpole, c. 360 km south of Warbrook, which is near Perth. (2) The habitat given for the other plants collected at Warbrook concurrently with *Royce* 8315 is very different from the known Walpole sites for the *Anthocercis*. (3) A search of the specimen database WAHERB, which was nearly complete for the PERTH collections, revealed that for *Royce* collections made from near Walpole, there was a series collected in September-October 1963 from which specimen 8115 was missing. This number differs from 8315 by only one digit, which would be an easily made error. *Royce*’s field notebook contains the entry “8115 5/10/63 Myrt.” [i.e. Myrtaceae], and two numbers earlier: “swampy heath. W. Nornalup.” [i.e. west of Nornalup]. There is a strong temptation to assume that 8115 was the *Anthocercis*, which subsequently was given the wrong label information as a result of an erroneous number tag. Problems with this interpretation are the reference to Myrtaceae, which is an unlikely attribution for this spiny *Anthocercis*; and the habitat, given under 8113 and differing from the known sites for the *Anthocercis*. However, this habitat may very well not apply to 8114 and 8115. Thus, in view of points 1-3 above, we suspect that the *Anthocercis* could really be the missing 8115. The fate of the real 8315, if any, is unknown.

Key to the spinescent species of *Anthocercis* (modified from Purdie *et al.* 1982)

- 1. Branches and leaves conspicuously pubescent
 - 2. Flowers white to cream; spines pubescent; corolla lobes glabrous at apex **A. anisantha**
 - 2. Flowers green and purple; spines usually glabrous; corolla lobes with hair tufts at apex **A. sylvicola**
- 1. Branches and leaves glabrous or sparsely pubescent
 - 3. Inflorescence usually branched; pedicels glandular-pubescent; most leaves at least 3 mm wide **A. intricata**
 - 3. Inflorescence not branched; pedicels glabrous or sparsely pubescent most leaves 0.5-2.5 mm wide
 - 4. Corolla lobes with minute hairs at apex **A. genistoides**
 - 4. Corolla lobes glabrous **A. anisantha**

General discussion

The new species conforms well to the current circumscription of *Anthocercis* (Purdie *et al.* 1982), but the flower colour is distinctive. The green is evidently darker than the “pale yellow-green” of *A. gracilis* (Purdie *et al.* 1982), and the purple, whilst present as markings in other species, in *A. sylvicola* occurs as solid colour all over the exposed corolla tube.

Anthocercis sylvicola is most closely related to *A. anisantha* Endl. and *A. genistoides* Miers, sharing with them a densely spiny habit, small leaves occurring initially singly or in twos and on older branches in small clusters, but deciduous, flowers in sessile cymose clusters or solitary terminally or away from the shoot apex, occurring lateral to spine bases, and an inland distribution. The other spinescent species, *A. intricata* F. Muell., has sparse spines, larger leaves, though arranged as in the preceding species, flowers in pedunculate cymose inflorescences with open branching, and a coastal distribution.

A. genistoides differs from *A. sylvicola* in having larger flowers with a whitish corolla, leaves usually grooved or channelled on the upper surface instead of flat or slightly folded along the midline, fully rather than incompletely deciduous leaves, axes glabrous and minutely papillose, instead of hispid, and in being usually leafless in the warmer months of the year instead of always at least sparsely, usually densely, leafy. *A. anisantha* differs in having usually larger flowers with a whitish corolla, leaves and stems very densely glandular-hairy (except for the non-glandular-hairy or glabrous subspecies *collina* Haegi from the Northern Eyre Peninsula, South Australia) instead of non-glandular, in being more sparsely hispid, with hairs usually absent from spines and exterior of calyx, and sparse on leaves, and in having fully deciduous leaves.

This group of spiny species, plus *A. gracilis* Benth., tend to shed their leaves and generate new ones from buds lateral to the spines, with the clusters of new leaves often growing out as new shoots. Thus they are, in effect, deciduous plants, partially so in *A. sylvicola* and *A. anisantha* in that there is apparently no leafless period, fully so in *A. genistoides* and *A. gracilis*, in which the plants are leafless during the warmer, drier part of the year.

The habit of this species is unusual, particularly in areas long unburnt, and is suggestive of a clonal growth habit. All populations have been regularly examined for viable seed over several months of the flowering, and post-flowering season. Although a few post-anthesis non-viable capsules were collected, no viable seed has been noted and the capsules are apparently shed before full development has occurred. It is possible that the species seeds episodically in unusual conditions and that, like many other species in the genus, it has long-lived soil-stored seed. If that were the case the species might well become more abundant following fire. However, no seedlings were observed following a moderate intensity fire in the autumn of 1994 in an area adjacent to the Mt Clare population. The long flowering period and moderate abundance of flowers suggests that the pollinator may have become rare or extinct. The flowers produce a faint scent, and insects have been observed visiting the flowers (S. Watkins pers. comm.). One of us (TDM) found blowflies (Diptera: Calliphoridae) to be the predominant visitors during one short observation period at Granite Peak.

The habitat of this species is not unusual in the Walpole area and similar sites exist in Karri/Tingle forest as islands of habitat throughout the Tingle Mosaic. Other sites identified as occurring in the same community type (10 of 446 quadrats in the survey area among which 44 community types were identified) occurred in Soho, Crossing (Mt Frankland National Park), and Ordnance Forest Blocks. Nevertheless, only one quadrat included this species. A total of 89 quadrats were located within tall open-forest, chiefly of Red Tingle, Yellow Tingle or Karri. It is possible that further populations of this species await discovery, particularly in the Soho hills, although the dense vegetation and poor access of the area would make survey difficult.

The discovery of a species of *Anthocercis* confined to tall open-forest of the High Rainfall Zone (*sensu* Hopper 1992) is of significance. Its two closest relatives, also in the south-west, are species of the Transitional Rainfall Zone. Although *A. gracilis*, another local endemic, is also a forest species of the High Rainfall Zone, it occurs in the more seasonal environment of the Darling Scarp. *Anthocercis sylvicola* is the first species found in the forest of the least seasonal, high-rainfall area of the State.

Distribution patterns and chemistry demonstrate that both the genus *Anthocercis* and tribe Anthocercideae are conservative and relictual. Based on the occurrence of both tropane and nicotinic alkaloids, and the range of trichome hair types found in the tribe Anthocercideae, Haegi (1986, 1992) argues that this tribe represents stock that has long undergone independent evolution. Symon (1992)

argues that the tribe represents an ancient lineage separated since the time Australia broke from Gondwanaland, based on diverse speciation patterns and the scattered distribution of the respective genera across Australia.

The environments of the Walpole area have been described as having micro-habitats that are the most akin of any in the south-west, to those existing at the time of Gondwana (Main & Main 1991, Wardell-Johnson & Horwitz in press). Hope & Kirkpatrick (1989), however, warn against labelling existing species or environments as Gondwanic as no extant community can be regarded as reflecting conditions as they were in the early Paleocene more than 50 million years BP. Nevertheless, the general area (Warren Botanical Subdistrict) has been shown to be the most important centre of endemism for conservative high rainfall taxa in the State (Hopper *et al.* 1992).

The Walpole area in particular is known for many conservative taxa of disjunct distribution in areas of granite outcrop (e.g. three *Eucalyptus* species, *Chamelaucium forestii* and *Chamelaucium* sp. undescribed) or swampy terrain (e.g. *Eucalyptus ficifolia* and *Reedia spathacea*). The occurrence of populations of this species near areas of high relief is notable. For example, Mt Clare (190 m) and Granite Peak (360 m) are the highest points in the landscape in their respective areas. The continuing discovery of new, possibly relictual, high-rainfall taxa with disjunct distributions supports notions of recurring climatic changes and periodic isolation of hilltops during marine transgressions (Roberts *et al.* in press, Wardell-Johnson & Horwitz in review) as isolating mechanisms for populations over a long period.

It is possible that this species represents an early lineage in the genus *Anthocercis*. The unusual habit, the possibility of containing chemicals of major pharmaceutical significance (given the frequency of secondary compounds occurring in the Solanaceae), and the possible relictual nature of this species, make it worthy of more detailed taxonomic and ecological investigation. Phytochemical and electrophoretic studies may be especially revealing.

Acknowledgements

We thank the following for assistance with aspects of the work: Tony Annels and Roger Hearn for helping with field observations and collections, including the discovery of the Granite Peak population, S. Watkin for field observations, C. Vellios and I. Wheeler for field assistance during the vegetation surveys which led to the relocation of the new species, the Director of the Western Australian Herbarium (PERTH) for access to the collections and specimen database, and Paul Wilson for translating the Latin description.

References

- Haegi, L. (1981). A conspectus of Solanaceae tribe Anthocercideae. *Telopea* 2: 173-180.
- Haegi, L. (1986). The affinities of *Anthocercis* (Solanaceae) and related genera. In: D'Arcy, W. (ed.) "Solanaceae Biology and Systematics." pp. 27-40. (Columbia University Press: New York.)
- Haegi, L. A. R. (1992). Trichomes of Solanaceae tribe Anthocercideae. In: Hawkes, J.G., Lester, R.N., Nee, M. & Estrada, N. (eds) "Solanaceae III: Taxonomy, Chemistry, Evolution." pp. 181-195. (Royal Botanic Gardens Kew and Linnean Society of London: Richmond, Surrey.)
- Hearn, R.W. (1994). Southern Forest Region Threatened Flora Recovery Team, Annual Report. Unpublished report to the Australian Nature Conservation Authority and the Department of Conservation and Land Management, Western Australia.

- Hope, G. S. & Kirkpatrick, J.B. (1989). The ecological history of Australian forests. *In*: Frawley, K. (ed.) "Australia's Ever Changing Forests." pp. 3-22. (University College, ADFA: Canberra.)
- Hopper, S.D. (1992). Patterns of plant diversity at the population and species levels in south-west Australian mediterranean ecosystems. *In*: Hobbs, R.J. (ed.) "Biodiversity of Mediterranean Ecosystems in Australia." pp. 27-46. (Surrey Beatty & Sons: Chipping Norton.)
- Hopper, S.D., Keighery, G. J. & Wardell-Johnson, G. (1992). Flora of the Karri forest and other communities in the Warren Subdistrict of Western Australia. *In*: "Research on the impact of Forest Management in South-West Western Australia." Occasional Paper 2/92, pp. 1-32. (Dept Conservation & Land Management: Perth.)
- Main, A.R. & Main, B.Y. (1991). Report on the southern Forest Region of Western Australia. Report to Australian Heritage Commission, Canberra. (unpublished).
- Mace, G., Collar, N., Cooke, K., Gaston, J., Leader Williams, N., Maunder, M. & Milne-Gulland, E. J. (1992). The development of new criteria for listing species on the IUCN Red list. Newsletter of the Species Survival Commission 19: 16-22.
- Purdie, R. W., Symon, D.E. & Haegi, L. (1982). *Anthocercis*. *In*: "Flora of Australia." Vol. 29, pp. 6-13. (Australian Government Publishing Service: Canberra.)
- Roberts, J.D., Horwitz, P., Wardell-Johnson, G., Maxson, L.R. & Mahony, M.J. (in press). Taxonomy, relationships and conservation of a new genus and species of Myobatrachine frog from the high rainfall region of southwestern Australia. *Copeia*
- Symon, D. E. (1992). Gondwanan elements of the Solanaceae. *In*: Hawkes, J.G., Lester, R.N., Nee, M. & Estrada, N. (eds) "Solanaceae III: Taxonomy, Chemistry, Evolution." pp. 139-150. (Royal Botanic Gardens Kew and Linnean Society of London: Richmond, Surrey.)
- Wardell-Johnson, G. (1994). A floristic survey of the Tingle mosaic. Unpublished report to the Heritage Council of Western Australia.
- Wardell-Johnson, G. & Horwitz, P. (in press). Conserving biodiversity and the recognition of heterogeneity in ancient landscapes: a case study from southwestern Australia. *For. Ecol. Manage.*